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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Timothy J. Oyer, Ph.D.
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EXAMINER

SORKIN, DAVID L

ART UNIT	PAPER NUMBER
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1723

DATE MAILED: 10/03/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/766,108

Applicant(s)

STROOK ET AL.

Examiner

David L. Sorkin

Art Unit

1723

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-67 is/are pending in the application.
- 4a) Of the above claim(s) 53-67 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-52 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-52, drawn to a device having a channel, classified in class 138, subclass 40.
 - II. Claims 53-62 and 67, drawn to a method of mixing material under laminar flow conditions, classified in class 366, subclass 348.
 - III. Claims 63-66, drawn to a method of molding, classified in class 264, subclass 299.

The inventions are distinct, each from the other because of the following reasons:

2. Inventions I and II are related as process and apparatus for its practice. The inventions are distinct if it can be shown that either: (1) the process as claimed can be practiced by another materially different apparatus or by hand, or (2) the apparatus as claimed can be used to practice another and materially different process. (MPEP § 806.05(e)). In this case the apparatus could be used in turbulent (Reynolds number > about 2300) flow situations, rather than the laminar flow (low Reynolds number) conditions required by the method of using.

3. Inventions I and III are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process

Art Unit: 1723

(MPEP § 806.05(f)). In the instant case, the apparatus could be made through etching rather than molding.

4. Inventions II and III are related as process of making and process of using the product. The inventions are distinct for the following reasons. The method of making could make an article which is not used under laminar flow conditions, but instead under turbulent flow conditions. The method of using could involve an article made by etching rather than by molding.

5. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

6. Because these inventions are distinct for the reasons given above and the search required for each Group is different, restriction for examination purposes as indicated is proper.

7. During a telephone conversation with Timothy J. Oyer on 27 September 2005 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-52. Affirmation of this election must be made by applicant in replying to this Office action. Claims 53-67 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

8. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim

remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Claim Rejections - 35 USC § 112

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 17-19 and rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. These claims are confusing because they require a "second set" of grooves or protrusions, without requiring a first set.

Claim Rejections - 35 USC § 102

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000.

Art Unit: 1723

Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

12. Claims 1,5-11,13-30, 32, 35-42, 45-47, 49 and 50 are rejected under 35 U.S.C. 102(a & e) as being anticipated by Larsen (US 6,241,379) and under 35 U.S.C. 102(b) as being anticipated by the corresponding WIPO publication, WO97/28894. All column and line numbers referred to herein below refer to the U.S. patent. Regarding claim 1, Larsen ('379) discloses a an article (1) comprising a microfluidic channel (3) designed to have fluid flow therethrough in a principle direction, the channel including a surface having at least one groove or protrusion (7) having a first orientation that forms an angle relative to the principle direction (see Figs. 4-7). Regarding claim 5, the substrate is a polymer (see col. 8, lines 23-24). Regarding claim 6, the angle is less than 90 degrees (see Figs. 4-7 and col. 7, lines 35-41). Regarding claim 7, the groove or protrusion has a depth that is less than a width of the channel (see Figs. 1 and 4-7). Regarding claim 8, the groove or protrusion has a depth less than a depth of the channel (see Figs. 1 and 4-7). Regarding claim 9, the groove or protrusion has a width that is less that a width of the channel (see Figs. 1 and 4-7). Regarding claim 10, the channel includes a first inlet (2). Regarding claim 11, the channel has a second inlet (11). Regarding claim 13, there are a plurality if grooves or protrusions of the surface (see Figs. 4-7). Regarding claim 14, the grooves or protrusions are parallel (see col. 5, line 16; Fig. 4-7). Regarding claim 15, the parallel grooves or protrusions are periodically spaced to form a first set (see Figs. 4-7). Regarding claim 16, the channel has a width and the first set of parallel periodically spaced grooves or protrusions

Art Unit: 1723

traverse the width (See Figs. 4-7). Regarding claim 17, the channel has a second set of parallel periodically spaced grooves or protrusions traversing at least a portion of the channel surface at a second orientation (see Figs. 4-7). Regarding claim 18, the second set of parallel periodically spaced grooves or protrusions are at least partially coextensive with the first set (see Figs. 4-7). Regarding claim 19, the first and second sets form a repeating pattern (see Figs. 4-7). Regarding claim 20, the groove or protrusion has at least two sections (see Figs. 4-7). Regarding claim 21, at least one section is substantially linear (See Figs. 4-7). Regarding claims 22-24, a plurality of chevron shaped grooves are periodically spaced along the channel surface (see Fig. 7). Regarding claim 25, a second groove or protrusion is defined in the channel surface, the second groove or protrusion having a second orientation relative to the principle direction (see Figs. 4-7). Regarding claim 26, the substrate has a network of microfluidic channels (11) connected to the channel. Regarding claim 27, the microfluidic channel is formed in a unitary substrate (see col. 6, lines 18-27). Regarding claim 28 and 36, Larsen ('379) discloses a an article (1) comprising a microfluidic channel (3) constructed and arranged to a have a fluid flowing therethrough while creating a transverse component. Regarding claims 29 and 30, Reynolds number being low is achieved simply be having a low flow rate; therefore, these claims do not further structurally limit the claimed article. Regarding claim 32, a network of microfluidic channels (11) are fluidically connected to the channel. Regarding claim 35, the channel has a rectangular cross section (see Fig. 5). Regarding claim 37, Larsen ('379) discloses a an article (1) comprising a structure having a channel (3) defined therein,

Art Unit: 1723

the channel designed to have a fluid flowing therethrough in a principle direction, the channel including a channel surface having a plurality of chevron shaped grooves or protrusions formed there in at least a portion of the channel surface so that each chevron-shaped groove or protrusion has an apex that defines an angle (see Fig. 7). Regarding claim 38, the apex angle is about 45 degrees (see Fig. 7). Regarding claim 39, the channel includes a first set of chevron shaped grooves or protrusions and a second set of chevron shaped grooves or protrusions (see Fig. 7). Regarding claim 40, the apex of each of the first set of chevron-shaped grooves or protrusions are aligned relative to the apex of each of the second set of chevron shaped grooves or protrusions. Regarding claim 41, the structure comprises a capillary tube (11). Regarding claim 42, the structure comprises a polymer (see col. 8, line 23). Regarding claim 45, the channel is fluidically connected to a network of microfluidic channels (11). Regarding claim 46, the chevron-shaped grooves or protrusions are periodically spaced from each other (see Fig. 7). Regarding claim 47, the channel has a rectangular cross section (see Fig. 5). Regarding claim 49, the channel is a microfluidic channel (see col. 1, lines 12-36). Regarding claim 50, the channel is defined on a unitary structure (see col. 6, lines 18-27).

13. Claims 28-34 and 36 are rejected under 35 U.S.C. 102(b) as being anticipated by Lui et al. "Passive Mixing in a Three-Dimensional Serpentine Microchannel", Journal of Microelectromechanical Systems, vol. 9, No. 2, pages 190-196. Regarding claims 28 and 36, Lui et al. discloses an article comprising a microfluidic channel constructed an arranged to have a fluid flowing therethrough while creating a transverse flow

component in the fluid (see page 191, including the top embodiment of Fig. 1).

Regarding claim 29, while Lui et al. expressly discloses Reynolds numbers in the claimed ranges (see pages 194 and 195), Reynolds number being low is achieved simply by having a low flow rate; therefore, these claims do not further structurally limit the claimed article. Regarding claim 31, the microfluidic channel has a width of less than about 1000 microns (see page 191, the first full paragraph of the second column).

Regarding claim 32, a network of microchannels are fluidically connected to the channel (see page 191, first full paragraph of the first column). Regarding claim 33, the channel creates a helical path (see Fig. 1 and the first full paragraph of page 191).

Regarding claim 35, the channel has a rectangular cross-section (see Fig. 1).

14. Claims 1-20, 25-32, 34-36, 51 and 52 are rejected under 35 U.S.C. 102(b) as being anticipated by Desai et al. (US 5,921,678). Regarding claim 1, Desai ('678) discloses an article comprising a microfluidic channel (for example 140) defined therein designed to have a fluid flow therethrough in a principle direction, the channel having at least one protrusion (510) that forms an angle relative to the principle direction (see Figs. 5A and 5B). Regarding claims 2-4, channels being 150 microns deep are disclosed (see col. 4, lines 34-40). Regarding claim 5, the substrate comprises a polymer (see col. 5, lines 11-12). Regarding claim 6, the angle is less than 90 degrees (see Fig. 5A). Regarding claim 7, the protrusion has a depth that is less than the width of the channel (see Fig. 5B; col. 4, lines 35-40). Regarding claim 8, the protrusion has a depth that is less than a depth of the channel (see col. 5, lines 62-63). Regarding claim 9, the protrusion has a width that is less than a width of the microfluidic channel (see Fig. 5B).

Art Unit: 1723

Regarding claims 10 and 11, the channel has first and second inlets (corresponding to 110 and 112). Regarding claim 12, the channel includes a portion with a circular cross section (see Fig. 2). Regarding claim 13, a plurality of protrusions (510) are formed on the surface of the channel (see Fig. 5A). Regarding claim 14, the protrusions are parallel to each other (see Fig. 5B). Regarding claim 15, the protrusions are periodically spaced (See Fig. 5A). Regarding claim 16, the first set of parallel periodically spaced protrusions is transverse to the width (see Figs. 5A and 5B). Regarding claim 17, the channel has a second set of parallel periodical spaced protrusions (see Fig. 5A). Regarding claim 18, the protrusion are at least partially coextensive (see Fig. 5A). Regarding claim 19, the protrusions form a repeating pattern (see Fig. 5A). Regarding claim 20, anything can be reasonably consider to have any number of "sections". Regarding claim 25, a second protrusion is disclosed (see Figs. 5A and 5B). Regarding claim 26, the substrate has a network of microfluidic channels fluidically connected to the channel (see Fig. 2). Regarding claims 28 and 36, a microchannel (for example 140) is constructed can arranged to have a fluid flowing therethrough while creating a transverse flow component in the fluid (see Fig. 5A). Regarding claims 29 and 30, Reynolds number being low is achieved simply be having a low flow rate; therefore, these claims do not further structurally limit the claimed article. Regarding claim 32, a network of microfluidic channels are fluidically connected to the channel (see Fig. 2). Regarding claims 34 and 35, both circular and rectangular cross sections are disclose (see Figs. 2 and 5B). Regarding claim 51, Desai ('678) discloses a structure comprising a first channel (110) having a width less than about 1000 microns (see col. 4, lines 35-

Art Unit: 1723

30); a second channel (112) having a width of less than about 1000 microns (see col. 4, lines 35-40); and a third channel (140) having a principle direction and a width less than about 1000 microns (see col. 4, lines 35-40), the third channel connecting the first and second channels and comprising channel surfaces having protrusions (510) defined therein, the protrusions at an angle relative to the principle direction (see Fig. 5A).

Regarding claim 52, the structure comprises a polymer (see col. 5, lines 11-12).

Claim Rejections - 35 USC § 103

15. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

16. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

17. Claims 2-4, 12, 31, 34, 43, 44 and 48 rejected under 35 U.S.C. 103(a) as being unpatentable over Larsen (US 6,241,379). The term "micromixer" (see col. 1, lines 11-36), would have suggested dimensions within the claimed ranges to one of ordinary skill

in the art. See *In re Dailey* 149 USPQ 47 (CCPA 1966) regarding the obviousness of selecting a shape.


Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David L. Sorkin whose telephone number is 571-272-1148. The examiner can normally be reached on 9:00 -5:30 Mon.-Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda L. Walker can be reached on 571-272-1151. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


David L. Sorkin
Primary Examiner
Art Unit 1723

DLS